

What is claimed is:

1. A FIPS-compliant QKD-based encryption system, comprising:

5 a FIPS-complaint VPN having first and second VPN stations;

a classical encryption system having first and second operatively connected encryption/decryption (e/d) processors operatively connected to the first and second VPN stations, respectively;

10 a QKD system having first and second operatively connected QKD stations respectively operatively connected to the first and second e/d processors, the QKD system being adapted to exchange a quantum key between the first and second QKD stations and provide the quantum key to the first and second e/d processors; and

15 wherein the classical encryption system is adapted to receive a VPN signal from the VPN and encrypt the VPN signal using the quantum key.

2. The system of claim 1, further including first and second transmitting/receiving stations operatively connected to the first and second VPN stations, respectively, wherein the first and second transmitting/receiving stations are adapted to transmit and/or receive plaintext signals to and from the respective first and second VPN stations.

20 3. The system of claim 1, wherein the first and second e/d processors are connected by an Ethernet section.

25 4. The system of claim 1, wherein the first and second VPN stations are computers.

30 5. The system of claim 1, wherein the e/d processors each include a quantum key storage device for storing the quantum key provided by the QKD system.

6. A FIPS-complaint QKD-based encryption system, comprising:
a FIPS-compliant VPN layer;
a classical encryption layer operatively connected to the FIPS-compliant
VPN layer;

5 a QKD layer operatively connected to the classical encryption layer; and
wherein the QKD layer provides a quantum key to the classical encryption
layer so that the classical encryption layer is capable of encrypting information
from the FIPS-compliant VPN layer using the quantum key.

10 7. The system of claim 6, wherein the classical encryption layer includes first
and second encryption/decryption (e/d) processors, and wherein:

the QKD layer includes first and second QKD stations respectively
operatively coupled to the first and second e/d processors and adapted to
symmetrically distribution the quantum key to the first and second e/d
processors.

8. A FIPS-compliant encryption system comprising:

first and second transmitters/receivers operatively connected through a
FIPS-compliant VPN;

20 a classical encryption system operatively connected to the FIPS-
compliant VPN and to a QKD system; and

wherein the QKD system provides a quantum key to the classical
encryption system, which then uses the quantum key to encrypt and decrypt a
plaintext signal input from one of the first and second transmitters/receivers.

25 9. The system of claim 8, wherein the classical encryption system is FIPS-
compliant.

10. A method of forming a FIPS-compliant QKD encryption system using a FIPS-compliant VPN, the method comprising:

forming a classical encryption link by operatively connecting first and second operatively connected encryption/decryption (e/d) processors to respective first and second VPN stations of the FIPS-compliant VPN; and

5 operatively connecting first and second operatively connected QKD stations of a QKD system to the first and second e/d processors, respectively, the first and second QKD stations capable of exchanging a quantum key and providing the quantum key to the first and second e/d processors.

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11. The method of claim 10, including operatively connecting first and second transmitting/receiving stations to the first and second VPN stations, respectively, wherein the first and second transmitting/receiving stations are adapted to transmit and/or receive plaintext signals.

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12. The method of claim 10, including operatively connecting the first and second e/d processors by an Ethernet section.

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13. A method of transmitting an encrypted signal between first and second transmitting/receiving stations, comprising:

sending a first plaintext signal from the first transmitting/receiving station to a first VPN station of a FIPS-compliant VPN;

converting the first plaintext signal to a first VPN signal at the first VPN station;

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providing the first VPN signal to a first encryption/decryption (e/d) processor of a classical encryption system also having a second e/d processor;

exchanging a quantum key between first and second QKD stations in a QKD system and providing the quantum key to the first and second e/d processors;

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forming an encrypted VPN signal from the first VPN signal at the first e/d processor using the quantum key provided to the first e/d processor;

forming a decrypted VPN signal from the encrypted VPN signal at the second e/d using the quantum key provided to the second e/d processor;

forming second plaintext signal from the decrypted VPN signal at a second VPN station in the VPN; and

5 receiving the second plaintext signal at the second transmitting/receiving station.

14. A method of forming a FIPS-compliant encryption system that utilizes quantum key distribution (QKD), comprising:

10 providing a FIPS-compliant VPN;

forming a classical encryption link within the FIPS-compliant VPN; and

providing a quantum key to the classical encryption link so that the classical encryption link is capable of encrypting information input to the FIPS-compliant VPN using the quantum key.

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15. The method of claim 14, wherein the classical encryption link includes first and second encryption/decryption (e/d) processors, and further including:

interfacing the first and second e/d processors with respective first and second QKD stations; and

20 performing symmetric quantum key distribution between the first and second QKD stations and the first and second e/d processors.

16. The method of claim 14, including forming the classical encryption link with a FIPS-compliant classical encryption link.

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